PULLORUM DISEASE

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OHIO AGRICULTURAL EXPERIMENT STATION

Special Circular No. 33

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The destructive nature of pullorum disease, or bacillary white diarrhea, is recognized by many poultrymen. Its economic importance has attracted the attention of investigators and attempts have been made during recent years to control and prevent this widespread disease of poultry.

This disease usually affects baby chicks but causes occasional losses among mature fowls. In baby chicks it is generally an acute, highly fatal, septicemic disease. In adult hens the infection usually localizes in the ovary, and the disease assumes a chronic form.

Pullorum disease is caused by the bacterium, *Salmonella pullorum.* This organism can be distinguished from other closely related bacteria by certain specific characteristics. Usually, it is possible to determine definitely the presence of this infection in fowls by a bacteriological examination.

THE DISEASE IN CHICKS

The infection generally manifests itself a few days after hatching and deaths may occur at that time and continue for three or four weeks.

Most outbreaks of this disease can be traced directly to the presence of infected hens in flocks from which eggs for hatching are obtained. Not all the eggs from diseased hens harbor the infection. Many infected eggs fail to hatch, as the infective agent of pullorum disease is apparently able to kill the developing embryos. However, should one or more chicks harboring the disease be hatched, the others of the brood will soon become infected as the infected chicks become a source of spreading the disease in the incubator. The spread among chicks in the incubator is mainly through down and dust. In many instances the infection is probably acquired by inhalation. The infected chicks also discharge the organisms in their feces, contaminating the litter, feed, and water in the brooder, and thus the disease may be spread to other chicks which were not infected through the egg or in the incubator. Another source of infection is through incubators and brooders that were previously occupied by diseased chicks.

The greatest danger of infection is during the first days of life. The chicks apparently do not develop the acute form of this disease when exposed to the infection after the fourth day. When very

young chicks are fed cultures of *Salmonella pullorum*, they generally develop symptoms of the disease and usually die. The period of incubation is from four to ten days.

Many of the infected chicks die and those that recover may become carriers. Usually about 25 per cent of the chicks which recover retain the infection. Pullorum disease perpetuates itself mainly by being transmitted from the infected hen through the egg to the chick; the recovered chick later produces infected eggs.

SYMPTOMS IN CHICKS

Chicks from infected eggs show symptoms soon after hatching. In some cases the chicks die and reveal few symptoms. Those that live for a few days eat little or nothing, huddle together, and have a sleepy attitude. The wings droop, the chicks appear dejected, and remain under the hover much of the time. A thin, whitish bowel discharge soon appears, which on drying forms chalk-like material, usually closing the cloaca—a condition frequently spoken of as being "pasted up behind". A peculiar cry is often heard when the droppings are voided, and the chicks chirp or peep continuously. In many cases the abdomen appears large, the back short, and lameness is often seen when the chicks attempt to walk. The symptoms of pullorum disease are not sufficiently characteristic to distinguish it from other bowel troubles, and a bacteriological examination is necessary to make a diagnosis.

Pullorum disease is usually fatal, and it is not uncommon to lose from 40 to 75 per cent of the chicks. Sometimes all the chicks in a brood die of this disease, making it almost impossible to rear chicks from infected flocks. Chicks that survive often remain stunted and unthrifty for a long time.

POST-MORTEM FINDINGS

Frequently, only a few changes are observed on post-mortem examination, the rapid and early development of the disease preventing the formation of any characteristic lesions. In those cases where the disease has lasted for some time the loss of flesh is very noticeable and the muscles of the wings and legs may be greatly wasted. Often, gray or yellowish necrotic areas or nodules are present in the lungs and heart muscles. Occasionally, such areas also occur in the liver, spleen, and gizzard. The intestines are frequently filled with a grayish or brownish pasty material, and the intestinal wall is thickened and necrotic. At times, the liver is swollen and reveals gray, pin-point spots. An unabsorbed yolk may be present but this is not diagnostic of pullorum disease.

DIAGNOSIS

The most certain method of diagnosing this disease is by a bacteriological examination. Such an examination may be had by sending a number of the affected chicks to a diagnostic laboratory. The causative organism may be isolated from the blood of the heart and usually is present in the spleen, liver, kidneys, or yolk of an infected chick.

Pullorum disease must be differentiated from certain non-infectious conditions, especially those caused by faulty incubation, brooding, or feeding, as these too may lead to bowel disturbances.

It must also be differentiated from certain infectious conditions, the most important of which are coccidiosis and aspergillosis. Coccidiosis develops slower and most often affects chicks from three to six weeks of age. The hemorrhagic and necrotic areas in the intestinal wall frequently are characteristic of this disease. The coccidia are readily seen on microscopic examination.

In brooder pneumonia (Aspergillosis), a characteristic grayish or greenish growth may be observed in the respiratory tract. Microscopical examination will reveal the presence of the fungus causing this growth.

Clinically, pullorum disease is characterized by its early appearance, the occurrence of deaths a few days after hatching, and the high mortality during the first two or three weeks.

TREATMENT AND CONTROL

The control of pullorum disease should consist of prevention rather than cure. The so-called "cures" have little or no value, as it is impossible to reach the organisms after they have been distributed through the various organs by way of the blood. Sulphocarbolates, bichloride of mercury, permanganate of potash, or hypochlorite solution in the drinking water have been recommended to inhibit the growth of *Salmonella pullorum* and lessen the attack of the disease in chicks. It is questionable whether medicated drinking water is a factor in the control or prevention of pullorum disease.

When the disease appears it is advisable to kill and burn all visibly sick chicks. The brooder house and other equipment should be frequently cleaned and disinfected. The housing and feeding of chicks is important. Chicks hatched from infected stock may show a low death rate when properly brooded and fed. Good care increases their resistance to disease.

Regular fumigation with formaldehyde, together with strict sanitation in the hatchery, will prevent the spread of this disease to a marked extent. The formaldehyde is liberated at various intervals during the period of incubation and while the chicks are hatching. Effective fumigation is dependent on a relatively high humidity being maintained in the incubator. However, fumigation does not destroy the infection in the body of the chick or inside the egg. Diseased chicks may infect healthy chicks by contact, and it is important to remove all weak chicks immediately from the brood, as they may be infected.

Brooding on wire or hardware cloth will remove the droppings from the pen at the time they are voided, and darkening the brooder for the first few days will keep the chicks quiet. Both of these procedures will limit the spread of the disease from the ingestion of infected droppings.

THE DISEASE IN ADULT FOWLS

Infected hens usually do not show symptoms of the disease, and it is not a common cause of death in mature fowls.

The disease is frequently introduced into a flock by the purchase of eggs for hatching or of baby chicks. The female chicks recovering from pullorum disease often become carriers, harboring the infective agent, mainly, in the ovary. The organism causes many of the ova to become abnormal and some to undergo degeneration. The ovary of the infected hen may continue to function, and occasionally an ovum is released which contains the organism. Cases have been reported where from 50 to 70 per cent of the hens in a flock were infected.

In hens the infection is generally localized in the ovary; while in cocks it may sometimes be present in the pericardial sac and very rarely in the testicles. It may be possible for the male birds to carry the infection from one hen to another, as hens have been infected experimentally by injecting the organism into the cloaca and oviduct. The disease seems to spread more rapidly among hens when males are present in a flock. Ovarian infection can also be produced by eating infected eggs. Adult hens may become infected by association with infected hens through contaminated litter. A hen with an infected ovary may continue to lay, but production is usually diminished.

SYMPTOMS AND LESIONS

In the chronic form no symptoms are observed and the lesions are mainly confined to the ovary. Generally, the ovary contains

several angular, hard, or discolored ova. The yolks may be of a greenish or dark brown color. Sometimes, only cysts are present, and occasionally yellowish colored bodies, either solid or containing a fluid, are pendent from the ovary or found free in the abdominal or thoracic cavities.

Adult fowls may develop a fatal septicemia due to *Salmonella pullorum* infection usually originating from a diseased ovary. In acute cases, the fowls show loss of appetite and appear listless, the comb and wattles are pale, sometimes cyanotic, and a diarrhea is often present. Deaths may occur within a few hours or a number of days after the onset of symptoms. Small necrotic foci may be observed in the liver, spleen, pancreas, and heart. A fibrinous exudate is frequently present on the liver, intestines, and pericardium.

DIAGNOSIS

Pullorum disease may be diagnosed in the adult, living bird by collecting blood and using the serum for the agglutination test. The finding of characteristic lesions in the ovary on post-mortem examination is diagnostic, and *Salmonella pullorum* may be isolated from the abnormal ova.

PREVENTION

Most outbreaks of pullorum disease in chicks can be traced directly to the presence of infected hens in flocks from which eggs for hatching were obtained. The means of prevention is by the elimination of infected breeding stock. Adult fowls that are carriers of the infection must not be used as breeders. All eggs for hatching should be obtained from flocks known to be free from the disease.

It is possible to lessen the ravages of this disease by proper incubation, care, and feeding. However, the care in housing and raising the chicks will not prevent heavy losses from this disease in all cases. The best way to attack pullorum disease is through the hens. Infected hens frequently are low in egg production or are non-producers and may be removed from the flock by trapnesting and culling. However, many of the hens that produce infected eggs can not be eliminated by these methods. Two other methods, the intradermal and agglutination tests, have been developed for detecting the infected hens and have been proposed as practical means for the eradication of this disease.

The intradermic or pullorin test is made by introducing into the wattle a product prepared from *Salmonella pullorum*. Observa-

tions are made from eighteen to twenty-four hours following the injection. A positive case is indicated by the appearance of a soft, edematous swelling at the point of injection. Care must be exercised in introducing the test fluid, and experience is necessary to interpret the results properly. It appears that the intradermal or pullorin test in its present state of development is not as satisfactory in detecting carriers of pullorum disease as is the agglutination test. At this time the pullorin test is not being used by the states officially engaged in eradicating the disease.

THE AGGLUTINATION TEST

The agglutination test is being used more extensively each year for diagnosing pullorum disease in mature fowls, and the results obtained by testing and removal of reactors justify confidence in the test when it is properly applied. It offers the most effective and practical means available at the present time for eradication and prevention of the disease.

The agglutination test consists in adding a small amount of blood serum from fowls to a dilute suspension of the organisms. If the fowls have the disease, the organisms will form clumps and settle to the bottom of the tube, and the fluid above will be clear. The blood serum from hens that are free from the disease will not cause the organisms to clump and the suspension will remain cloudy. The test should be made in a laboratory under the direction of a competent bacteriologist.

All the fowls in a flock should be tested, and those that react must be removed from the breeding pens and not allowed to associate with healthy hens. One test may not entirely eliminate the infection from a flock even if all reactors are removed. It is generally recognized that repeated tests may be necessary to detect all the infected fowls in a breeding flock. Apparently, the blood of some fowls that harbor *Salmonella pullorum* is subject to rapid changes which frequently cause discrepancies in the agglutination test. Fowls that are negative to repeated tests may later become positive if exposed to the infection in adult life.

One test during a season on an infected flock is not considered to be a reliable procedure for establishing pullorum disease-free flocks. It is recommended that a diseased flock be retested several times a season, or that the entire flock be disposed of and replacements obtained from known disease-free sources. Retests of infected flocks are to be made each month or six weeks until no

reactors are found. This method of testing is considered to be a more economical and successful means of eradicating this disease than a single annual test.

The unsuccessful attempts to eradicate pullorum disease from some flocks are often attributed to inaccuracies of the agglutination test. Failures are to be expected if only a portion of the flock is tested. All reactors must be removed immediately from the premises and not be retained for egg production purposes. The eggs from a disease-free flock should never be placed in incubators with eggs from untested flocks. Eggs, chicks, and mature stock should be purchased only from known disease-free flocks. Dispose of all infertile and dead-germ eggs and offal from reactors, so that they cannot infect healthy fowls. Thoroughly clean and disinfect the houses immediately after the reacting birds have been removed. If pullorum disease is to be eradicated from a flock by use of the agglutination test, it is of utmost importance to observe these precautions. The greatest progress toward the eradication of this disease can be made by establishing pullorum disease-free flocks for the purpose of supplying eggs for hatching, chicks, and breeding stock.